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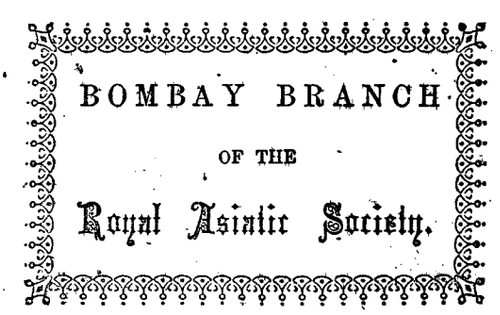

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Report of the Director of the Botanical Survey of India for the year 1901-02.

1. *Survey of Eastern India.*—The allotments provided for Botanical Surveys in Bengal, Assam, and Burma have been expended in full. In Bengal attention has been mainly confined during the past year to the Tributary States of Chutia Nagpur and to other outlying parts of the province. In Sikkim trained Lepchas have been employed in making collections of particular natural groups of plants that call for special study. In Assam attention was principally devoted to an exhaustive collection of the plants constituting the rabi crops of the province. In Burma the botanical exploration of the Tenasserim forests was continued.

2. *Survey of Northern India.*—The principal botanical survey work of the year was in Kashmir where, as in the Eastern Himalaya, attention was chiefly given to particular families of plants that require special study.

3. *Survey of Western India.*—The chief botanical survey work of the year was done in the Southern Mahratta country and in the districts of Satara and Poona. Special visits were also paid to various localities in order to obtain material illustrative of particular species required to assist Dr. T. Cooke in the preparation of his *Flora of the Presidency of Bombay*, of which two parts have so far appeared.

4. *Survey of Southern India.*—In connection with this survey special attention was devoted to the nature and composition of the Tinivelly and Anamalai forests.

5. *Publications.*—The concluding part of the first volume of the *Records of the Botanical Survey* (No. 13), which had been sent to press before the close of the previous year, was issued in July 1901. Two contributions to a second volume, Part 1, on the *Flora of Chutia Nagpur* by Surgeon Lieutenant-Colonel J. J. Wood, I.M.S., retired, and Part 2, on the *Plants used during famines and seasons of scarcity in the Bombay Presidency*, by Mr. G. A. Gammie, were sent to press, but were still unissued at the close of the year. The Director, while on leave in Europe, prepared in conjunction with Mr. E. G. Baker, of the British (Natural History) Museum, some *Notes on Indigofera*, in connection with his enquiry into the cultivated Indigos; this paper was published in the *Journal of Botany*. The *Flora of the Upper Gangetic Plain*, on which Mr. J. F. Duthie is engaged, has made considerable progress during the year.

6. *Economic and Agricultural Botany.*—Much attention continued to be given to various fibre-yielding species and to the question of the introduction from countries other than India of fodder-plants with a reputation for drought-resistance. Regarding plants of this class often exaggerated and sometimes erroneous opinions are entertained. The loss of cattle during seasons of drought is a calamity of appalling magnitute, the remedy for which is, unfortunately, not to be found in the introduction of exotic salt-bushes and similar drought-resisting plants. The numerous attempts that have been made to naturalise plants of this class in India show that, in tracts where, in a season of scarcity, the existence of such as fodders would be invaluable, they will not survive under what are to be considered normal meteorological conditions; while in tracts where they do thrive, and their cultivation or natural propagation might be pursued or encouraged with advantage, the introduction of exotic species is practically uncalled for, since these tracts already possess many quite as suitable and valuable native species. The systematic endeavours of the past two years to introduce into India an American fodder-grass, *Paspalum dilatatum*, which, on being imported to the Australian colonies,

gained in these latter a high reputation for its drought-resisting properties, affords an instructive instance of these facts. Various correspondents to whom seeds of this grass have been issued by the Director have kindly complied with his request to supply him with accounts of their experience. The reports from different provinces are somewhat conflicting. Partly on this account, and partly because the period over which the operations have extended does not coincide with the limits of an official year, the *précis* of these reports which has been prepared is given as an appendix to this report. It may, on the whole, be concluded that, as is usual in the case of popular estimates, the superlative merits attributed to this grass in public journals are not justified by actual facts. The Director's investigations of the natural characteristics of the dye-yielding Indigos have not yet been concluded. So far as they have gone they seem to indicate that the species now chiefly cultivated in Northern India is not the plant employed for the purpose in the time of the Emperor Akbar. The change of species no doubt resulted from the empirical discovery that the plant now grown, which is a Malayan form, is better suited to local conditions and more valuable as a source of the dye than the North African species which it replaced. It appears, however, that in a third species which is widely spread in South-Eastern and Eastern Africa we have a plant possessing many advantages over the kind now cultivated, and it becomes a question, if indeed the interest now shown by Indigo-producers in the plant from which the dye is obtained has not been too late of being aroused, whether a change similar to that effected a century ago might not again take place.

The experimental cultivation of the various Indian Yams (*Dioscorea* sp.) has been undertaken on behalf of the Reporter on Economic Products. The results of the first year's experiment have shown that another season's observation is necessary in order to clear up points that are still doubtful. It is proposed that a joint review of the results be drawn up by the two departments when the enquiry is complete.

The officer in charge of the Botanical Survey of Western India has made an exhaustive study of the various plants used in times of famine and scarcity in the Bombay Presidency. The officer in charge of the Survey of Southern India has continued his careful study of sugar-cultivation in the Godavari district. The various other economic enquiries undertaken during the year in Northern, Western and Southern India are referred to in the reports prepared by the respective officers in charge, and need not be recapitulated here, the three reports being submitted in original.

7. *Cryptogamic Botanist.*—This officer arrived at Calcutta on April 5th 1901, and was attached to the Botanical Survey throughout the year. The new officer, Dr. E. J. Butler, did much excellent work and greatly impressed the Director by the enthusiasm with which he laboured as well as by the expert knowledge and sound judgment he displayed in carrying out his investigations, which were all of a useful and practical nature. It having been found undesirable that the Cryptogamic Botanist should continue to be an officer of the Botanical Survey, he was removed at the close of the financial year. A detailed report on the work accomplished by him during 1901-02 will therefore reach Government through another channel.

8. *Staff.*—The Director was absent for six months from 20th June to 19th December 1901. The officer who officiated was Captain A. T. Gage, I.M.S. The surveys of Northern, Western and Southern India have been in charge of Messrs. J. F. Duthie, G. A. Gammie, and C. A. Barber, respectively, all of whom have done excellent work.

DAVID PRAIN,
Director, Botanical Survey of India.

Annual Report of the Director of the Botanical Department, Northern India, for the year 1901-02.

On the 1st of April, I returned to Saháranpur from Dehra, after taking part in the final examinations at the Imperial Forest School, and on the 10th of that month I left for Mussoorie, where I remained (except for a few days spent at Simla towards the end of September) until the 12th of November, A severe attack of influenza whilst at Dehra, followed by acute sciatica, unfortunately prevented my accompanying the Forest School students on their hill tour during the months of April and May, and also seriously interfered with my work at Mussoorie. I left Saháranpur about the middle of January for Calcutta, where I spent about a fortnight at the Royal Botanic Garden with Dr. Prain, to whom I am always much indebted for valuable assistance and kind hospitality. From the 18th of March until the end of that month I was at Dehra for the examinations at the Imperial Forest School.

Botanical Tours.—The only extensive tour undertaken during the year was in Kashmir, where I sent Ináyat Khán, my head plant collector, early in May. He spent about four months in that country, and the specimens he brought back were of great value. As the Kashmir flora is very largely represented in the Saháranpur herbarium, he was instructed to confine his attention chiefly to the collection of certain kinds of plants, specimens of which were required for special study. These special collections include very fine sets of all the different kinds of Balsams (*Impatiens*), and one complete set, together with flowers of each gathering preserved in spirit, has been despatched to Sir Joseph Hooker, who is preparing a monograph of the Indian species. He also made a very good collection of the Kashmir Irises, prepared in the same manner, and these have been sent to Mr. J. G. Baker, late Keeper of the Royal Herbarium and Library at Kew, and an eminent specialist in regard to the Iridaceæ and other allied natural orders. Some interesting orchids were also collected, including an undescribed species of *Neottia* and another belonging to the genus Orchis; also *Epipogum aphyllum* and *Listera ovata*, which latter had not been collected by anyone in India since Dr. Falconer discovered it in Kashmir many years ago. The particular parts of Kashmir explored by Ináyat Khán last year were the Pir Panjál range, and the Liddar, Sind, Drás and Gurais valleys; he also travelled as far as Astoe on the Gilgit road, returning by the Kamri route.

Herbarium.—The additions made to the herbarium during the past year include the following valuable contributions:—

1. From the Herbarium of the Royal Botanical Garden, Calcutta—230 sheets of interesting miscellaneous specimens.
2. From Dr. George Watt, Reporter on Economic Products to the Government of India, 4 kinds of Aconite which were not represented in the Saháranpur herbarium.
3. From Dr. R. G. Leavitt, the Ames Botanical Laboratory, North Easton, United States, America.—A collection of rare North American plants, including many kinds of orchids.
4. From Dr. A. Engler, Director of the Berlin Botanical Garden and Museum.—Sixty-four kinds of Mosses and Hepaticæ.
5. From Dr. N. Bryhn.—A large collection of beautifully prepared Norwegian Mosses.

Complete sets of the specimens collected in Hazára during 1899, in Kumáon in 1900, and in Kashmir during the past year have been mounted and incorporated. Fresh material representing the vegetation of North-West and Central India is being constantly added, and the value of the herbarium as a basis for the preparation of local floras has been increasing every year.

Local Floras.—The excellent Handbook on the Forest Flora of the School Circle, prepared by Mr. Upendranáth Kanjilál, Extra-Assistant Conservator of Forests, cannot fail to be of very great use, not only to those for whom the book was specially prepared, but to all who may wish to learn about the trees and shrubs of this part of India.

The late Sir Henry Collett's "Flora of the Simla District" is now being printed, and copies of this work ought soon to be in the hands of those who are anxious to study the botany of a characteristic portion of the Western Himalaya. This book will satisfy a demand far beyond the limits of the particular area dealt with, as so many of the Simla plants are found in other parts of the Himalaya. A special feature of the work is the large number of admirable illustrations.

'The Flora of the Upper Gangetic Plain and of the adjacent Siwálik and Sub-Himalayan tracts.' The area dealt with in this work, on which I have been engaged for the last three or four years, is much larger than was originally intended, *viz.*, the *Upper Gangetic Plain*, as defined in the Introductory Essay of Hooker and Thomson's "Flora Indica" published in 1855. By extending the area towards the south and west, so as to include the whole of the watershed supplying tributaries to the Jumna and Ganges as far as the Sone and Gandak junctions on the west; and by moving the boundary on the north-east up to the base of the Himalaya proper, so as to include the Siwálik range of hills and the intervening duns, such as Dehra Dun, a more compact area and a better defined boundary was possible. As, however, the flora of a large portion of the country included within the extended boundary is much richer than that of the original area, a very large number of additional species have to be accounted for. Notwithstanding the extra work entailed I am doing my best to have the book completed by the end of December next.

As to the remaining area allotted to the Botanical Survey Department of North India, the Saháranpur Herbarium contains ample material for the preparation of at least four more local floras :—

1. The plains of Punjab and Rájputána.
2. The Central Provinces.
3. The North-West Frontier.
4. The North-West Himalaya from Hazára and Kashmir to Kumáon.

Distribution.

Herbarium specimens.—Sets of duplicate specimens were distributed to the following addresses :—The Director, Botanical Survey of India, Calcutta; Director, Imperial Forest School, Dehra; the Director, Royal Gardens, Kew; the Keeper, Royal Botanic Garden, Edinburgh; Sir Dietrich Brandis, K.C.I.E., F.R.S., Kew; J. Sykes Gamble, Esquire, C.I.E., F. R. S., Hants, England; the Directors of the Royal Botanic Gardens at Berlin, Vienna, Florence and Strasburg; the Director, Imperial Gardens, St. Petersburg; the Director, Jardin des Plantes, Paris; M. Casimir DeCandolle, Geneva; the Boissier Herbarium, Geneva; MM. Copineau and Mouillefarine, France; Professor M. Gandoger, France; Dr. W. Lambart, Saxony, Germany; Dr. E. Rosenstock, Gotha, Germany; Sig. G. E. Mattei, Bologna, Italy; M. Usteri, Zurich, Switzerland; J. Medley Wood, Esquire, A.L.S., Durban, Natal; Mr. P. W. Wilson, Philadelphia Commercial Museum, U.S.A.; P. W. Mackinnon, Esquire, Mussoorie; Dr. R. G. Leavitt, N. Easton, Mass., United States, America (orchids); Professor R. Schlechter, Berlin (orchids and Asclepiadaceæ); Dr. Fritz Kränzlin, Berlin (orchids); Professor H. Marshall Ward, Cambridge (Indian species of Bromus); the Reporter on Economic Products to the Government of India (two kinds of Andropogon yielding Rusa or Nimár oil, together with samples of the oil); Dr. Alwah, Eaton, Seabrook, United States, America (species of Equisetum); Dr. N. Bryhn, Hönesfoss, Norway (a collection of Indian mosses); H. M. Lenox-Conyngham, Esquire, A.V.D., Allahábad (a collection of Indian Fodder grasses); Dr. Hemchandra Sen, Campbell Medical School, Calcutta (specimens of Indian medicinal plants).

In addition to the above, collections of Iris bulbs were despatched to Sir Michæl Foster, K.C.B., F.R.S., Cambridge; seeds of Himalayan plants to A. K. Bulley, Esquire, Cheshire, England; and seeds of Apocynum venetum, a valuable fibre plant, were sent to the Superintendent, Residency Garden, Quetta.

Office Establishment.—The draughtsman, H. Hormusji, has completed several excellent drawings of new and interesting plants, including nine kinds of orchids for the book now in preparation on the Orchids of North-West and Central India. His time is now fully occupied in colouring sets of the lithographed plates for that work.

My Head Clerk, Umráo Singh, and the Assistant Clerk, N. Hutchinson, have worked satisfactorily during the past year.

J. F. DUTHIE,
Director, Botanical Department, Northern India.

MUSSOORIE;
The 27th June 1902.

APPENDIX.

Financial Statement of the Botanical Department, Northern India, during the year 1901-02.

Botanical Department.	Expenditure.							Receipts.			
	Director's salary.	Exchange compensation allowance.	Establishment.	Travelling allowances of Gazetted Officers.	Travelling allowances of Establishment.	Contingencies.	Total.	Fodder Grass books.	Fodder Grass albums.	Miscellaneous.	Total.
	R a. p.	R a. p.	R a. p.	R a. p.	R a. p.	R a. p.	R a. p.				
Budget Grant for 1901-02 .	12,000 0 0	750 0 0	4,070 0 0	1,700 0 0	300 0 0	2,240 0 0	21,060 0 0	...	...	...	...
Expenditure during 1901-02	12,000 0 0	749 1 5	*4,204 10 4	992 8 0	290 5 6	2,231 11 0	20,468 4 3	...	...	...	...
Balance .	...	0 14 7	...	707 8 0	9 10 6	8 5 0	591 11 9	...	...	...	...
Realized by sale during 1901-1902.	...	...	...	...	...	...	...	34 8 6	...	...	34 8 6

* Includes R154-0-9 paid for halting allowances to the Draftsman and Assistant Clerk for haltings at Mussoorie. The actual expenditure during the year under this head, R4,050-9-7.

J. F. DUTHIE,
Director, Botanical Department, Northern India.

Mussoorie;
The 27th June 1902.

Report on the Botanical Survey Operations in the Bombay Presidency for the year 1901-02, by G. A. Gammie, F. L. S., Officer in charge of the Botanical Survey, Bombay Presidency.

I held charge of the office of the Botanical Survey, Bombay Presidency, throughout the year. Owing to the loss of my records in the disastrous fire which utterly destroyed the Herbarium on the 1st May 1902, I am unable to furnish complete details of some important investigations conducted during the year under report. Thanks to the generous offers of assistance tendered by many botanists, the labour of re-forming a Herbarium will be appreciably lightened.

1. *Tours.*—During the hot weather vacation I botanized closely over a part of the Poona Ghats on special researches and also undertook a journey through a portion of the Southern Maharatta country lying between Londa and Gokak. During the autumn vacation I went over the eastern and northern parts of the Poona district, engaged on special researches, and finally I visited the adjoining parts of Satara. I also paid a visit to Nandgaon to inspect the experimental plantation of Sisal Hemp.

Mr. Bhide, the Herbarium Keeper, made a tour in Kanara from Haveri to Devimona Ghat and to Castle Rock, and also visited the forests in the vicinity of the Kanheri Caves in Thana in search of plants required by Dr. Cooke to assist him in clearing up doubtful points for his Flora of Bombay. In addition I devoted much time to the supervision of plant-breeding experiments on the Poona Farm.

2. *Herbarium.*—Many sheets of specimens were incorporated, but these, of course, shared in the general destruction. The Superintendents of Victoria Gardens, Bombay and Empress Gardens, Poona, supplied many interesting plants for identification. Mr. V. R. Damb, a passed student of the college, now in the Forest service, was good enough to send specimens of noteworthy plants.

3. *Publications.*—In compliance with the instructions conveyed in the Resolution on my last report, I put myself in communication with the Collectors of the districts affected by the recent famine and, in response, I received a great number of plants said to have been used as food during that time. These were identified after much labour, as many arrived in a condition unfavourable for botanical examination. The vernacular names under which they were sent were carefully noted. Being plants used as food I thought that the names given would probably be correct. Our knowledge of the vernacular names of the smaller plants, especially those of Gujerat, is still very incomplete. A full list of these plants was supplied to the Director, Land Records and Agriculture, for incorporation in the next edition of the Statistical Atlas, and a detailed account with notes was despatched as a contribution to the Records of the Botanical Survey of India. This will probably be published at an early date. Dr. T. Cooke (under the auspices of the Secretary of State for India) has published the second part of his Flora of Bombay, bringing his account down to the *Leguminosæ*.

4. *Catha edulis* Forsk,—*kât* of Arabia. My predecessor, Mr. Woodrow, drew the attention of the Director of Agriculture to the fact that a plant of this species grows in the College of Science Garden. It has attained a good height and its appearance is that of an overgrown tea plant. Within reach of irrigation it would thrive admirably in Poona and its history marks it as a plant worthy of a place in every large garden.

5. *Sisal Hemp.*—A large number of young plants were supplied to the Divisional Forest Officer, Nasik, and smaller numbers were despatched to the Revenue Department, Government of Madras, and to various applicants for experimental purposes.

By the courtesy of the Director, Land Records and Agriculture, I was allowed to put out 4,000 plants on a piece of grass land in the old Botanic

Garden at Ganesh Khind. These plants established themselves quickly and appear very vigorous and healthy. The plants at the experiment plot at Nandgaon are also thriving. As sisal culture is now an established industry, these two plots will suffice for experimental purposes. Another large consignment has been promised to the Divisional Forest Officer, Nasik. The plant could also be utilized as a profitable hedge in most localities in the Deccan. During the year eleven plants flowered and produced bulbils, but as their production has still not ceased, the number cannot be given till next year.

6. *Sabai Grass.*—No application for seed was received during the year. The Managing Agents of the Reay Paper Mills complain of the number of hard flower stalks which have to be sorted out before the material is fit for paper-making. I observed on their land that clumps in the shade did not develop flower stalks so numerously and therefore recommended that *Shevri* (Sesbania ægyptiaca, *Pers.*) should be grown throughout the plots. This is one of the quickest growing shrubs in the Deccan. It has a beneficial effect on the soil and is also a good fodder. An experiment was tried to test the suitability or otherwise of the climate for *Esparto* (Stipa tenacissima). The grains germinated well and the plants made fair growth during the cool season, but during the hot weather, they languished and merely lingered. As they did not altogether die they may yet become acclimatised, but the outlook is not promising.

7. *Economic Work.*—The examination of the famine plants has already been alluded to. An exhaustive study was made of the wheats grown on the Poona Farm, and the results of the investigation were forwarded to the Inspector General of Agriculture. A commencement was also made in the selection and hybridisation of several forms, and some men were trained to perform the latter operation. It will, of course, entail patient work for several years to produce tangible results. Several varieties liable to be affected with rust were crossed with *khapli* or spelt (which is absolutely rust-proof) to discover whether the progeny would inherit the rust-proof habit. A gentleman in the United States, who has paid much attention to the breeding of cereals, gave me the interesting information that the *khapli* of Western India is identical with the *emmer* of Siberia, which he was utilizing to produce rust resisting crosses.

The *Triticum pilosum* of Dalzell and Gibson is the *Bakshi*, which yields the finest hard white Bombay wheats. It is not, however, cultivated in the Concan but in the Deccan. I have to thank Mr. R. K. Bhide for his assiduous work in the Herbarium and field. Mr. Madane, the Head Plant Collector (who has since died, to my great regret), worked well, as did also Mr. L. D. Gharade, the Second Plant Collector.

GEORGE A. GAMMIE,
In charge of the Botanical Survey of Bombay Presidency.

POONA;
The 14th July 1902.

Annual Report of the Government Botanist, Madras.

I have the honour to forward the following annual report on the work done by my department. The period included is from 1st April 1901 to 31st March 1902.

2. The following were my movements during the year:—

The month of April was spent at Head Office. A careful study of the plague of cockchafers was made at Ootacamund and a long report prepared on the Gódávari sugar-canes.

On 8th May I left Head Office on a three months' tour in Tinnevelly. Collections of grasses were made at different parts of the district and special attention throughout the tour was devoted to forest trees in the mixed and evergreen forests. A short visit was paid to the sub-alpine region around Kalivayalpil and a large number of interesting plants were obtained in an ascent of Agastiar Malai (6,000 feet).

I reached Ootacamund after a short visit to Madras and remained there from 1st August to 2nd October. As some of the specimens were found to be mouldy, the whole collection was thoroughly overhauled. A certain amount of herbarium work was done during the monsoon, special attentions being devoted to the forest trees.

At the request of the Forest Department, the next tour, 2nd October to 17th November, was spent in the Anamalai forests. Here the evergreen forests were again carefully collected over. The weather was exceptionally bad, and most of the trees had neither flowers nor fruits upon them. A trip to the Grass Hills (7,000—8,000 feet) produced some interesting mountain plants.

From 17th November to 23rd January I remained at Head Office. A preliminary study was made of the Anamalai forest trees and a good deal of attention was devoted to experiments with white grubs and to preparations for the Gódávari sugar-cane station.

The remainder of the year was spent in the Gódávari district. A considerable time was devoted to the sugar-cane station, but the canals were toured over and a special study was made of the date palms of the neighbourhood.

3. It will be seen that there were two main collecting tours, both primarily in the evergreen forests, although other tracts were also traversed.

The high forest was studied at Kannikatti in the Tinnevelly Hills and at Paralai in the Anamalais.

Deciduous or mixed forest at Mundanthorai, Kannikatti, Courtallam and below Poonachi.

The sub-alpine flora was collected at Poonachi (5,000 feet), Kalivayalpil (4,000 feet), Agastiar Malai (6,000 feet), and the Grass Hills above Paralai (7,000—8,000 feet).

Considerable attention was paid throughout the year to grasses, and special collections were made at Palamcottah, Ambásamudram, Mundanthorai, Courtallam, Aulankolam, Pollachi, Poonachi, Ootacamund, Dwarapudi and Mandapeta, in order to determine their relative distribution.

It is too early to speak of the value of the collections made. Several undoubtedly new species have been found, and many valuable additions have been made to our collections of forest trees and grasses.

4. Progress in the herbarium has been considerably greater during the year. The work was hampered by a somewhat serious accident which kept the plant collector in hospital for some months, but the addition of a second assistant to the staff has made itself very distinctly felt. A larger number of plants was collected than in any previous year. This will be seen from the accompanying figures of plants collected during the last three years.

From January 1899 to March 1900 (tours in Madras, Tinnevelly, South Arcot and Ganjam) collection Nos. 1—1,500.

From 1st April 1900 to 31st March 1901 (tours in Vizagapatam and South Canara) collection Nos. 1,501—2,700.

From 1st April 1901 to 31st March 1902 (tours in Tinnevelly and the Anamalais) collection Nos. 2,701—4,300.

Over 4,000 sheets of specimens have been poisoned and mounted. The heavy arrears in the herbarium are being taken in hand and the constant attention of one assistant is devoted to the collections.

5. Several additions have been made to the herbarium from outside sources. A fine set of Assam ferns has been obtained by purchase; a set of grasses has been received from the Director of the Botanic Department, Sydney, New South Wales; and a certain number of ebonies and grewias from Ceylon. Sets of specimens were sent to the United States of America Agrostologist and the Botanic Departments in New South Wales, Ceylon, and Calcutta. A few specimens were sent to the Madras Museum for the Index collection and a number of spirit and dried plants obtained for Dr. Bourne for class work in the Presidency College.

6. A good deal more work of an economic character has been done during the year than in any previous one. Nevertheless, many matters have had to be left untouched and scant attention has been given to others.

The subject which has received most attention has been sugar-cane cultivation. A parcel of canes from Udamalpet was found to be infested with moth-borer, Chilo simplex. Traces of fungi were also found, but only in the hyphal condition, and therefore not determinable. The moth-borer, which causes the appearance known as "dead-heart" in the young canes, is known wherever the sugar-cane is grown. It usually is most abundant when the plants have had unseasonable weather in the early stages of growth. A short correspondence was carried on concerning the recent introduction into Vizianagram of a number of kinds of Mauritius canes. Special attention was again devoted to the canes in the Gódávari district. A long report was prepared at the begining of the year on the introduction of Hospet canes, and the months of January to March were devoted to the founding of an experimental sugar-cane station at Samalkot.

7. During the long halts at Samalkot a careful study was made of the mode of tapping and general life of the date palms of the district. It was noted that the mode of cutting the trees for toddy was very different from that practised in Vizagapatam, also that the number of deaths from overtapping was very much larger. It was not difficult also to find the palm weevil, Rhynchophorus ferrugineus, in the trees.

As it was not found possible to arrive at certain conclusions from casual visits to a number of different plantations, a definite area was submitted to an exhaustive analys's. Half a mile of date trees were counted and all the dead ones carefully examined. Two facts were at once evident. Firstly, all the trees had died shortly after tapping, for they always showed the slanting cut at the top, and secondly, the great majority of them had no trace of borer or other such injury, so that the conclusion was forced upon one that the chief cause of death was overtapping. A report on the subject was forwarded to the Board of Revenue.

8. The "white grub" of the Nilgiris received a good deal of attention during the year. These, it will be remembered, were held to be responsible for the failure of sowings of Seoni wheat which it was sought to introduce, and the Government Botanist was directed to make a study of them.

The "white grub" is the larval form of the cockchafer beetle. As it was discovered that the chief flights of the latter occurred during the April-May rains, collections were made with a view to identifying the species which were causing the damage. Specimens sent to Cambridge for determination proved them to be new or rare species, and a series of experiments were instituted in order to learn something of their life-history.

As is well known, the study of the life-history of cockchafers is one of great difficulty and takes years to accomplish. Pits were dug at various periods to find out the condition of the pests and the different species were sown in order to find out which grubs belonged to the different beetles. These observations are not yet completed. A number of facts have, however, been brought to light which indicate the way in which the pest can be combated.

9. A disease in the Wynaad pepper plantations received a certain amount of attention. After a careful examination of the specimens received it was decided that study at a distance was useless. Several pests were found, and it is always a matter of difficulty to determine which of these has attacked plants weakened from some other cause and which has made an onslaught on originally healthy plants.

10. In conclusion of this review of the economic work during the year, I will mention some of the many other subjects of minor importance which have engaged our attention.

The following were dealt with :—Rust in wheat from the Palnis; minute insects (Aptera) among Cinchona seedlings, determined to be harmless because of the character of their mouthparts ; smutted Sorghum, remedies suggested and a scheme of experiments with recent methods drawn up for the Saidapet farm; turnip fleas (Bagrada picta) in the Ootacamund gardens ; plant bugs (Nezara viridula var.) in the gardens and notably in the Cinchona plantations; difference in colour of coffee beans ; a destructive outbreak of green scale (Aspidiotus Camelliae) in the Kanan Devan Tea plantations; a coffee-root fungus in Coorg ; a disease of the prickly-pear, unfortunately received in bad condition; Striga euphrasioides, etc., as pests in badly cultivated lands; sandbinding plants as protection on the East Coast; salt bushes as fodder plants ; the requirements of the Durian tree as regards climate and elevation; fibre machines suitable for "Aloe fibre" ; and questions on Hydnocarpus, mosquitoes, Balsamodendron Berryi as a hedge plant, various species of Cassia as "senna," Tephrosia or "wild indigo" for green dressing, and many other references of minor importance.

11. A number of photographs have been taken of subjects of economic interest and a set of negatives has been sent to Dr. Watt for copying.

A considerable number of forest trees and shrubs have been named for forest officers.

A labelled collection of barks of Anamalai trees was made. These are to be handed over to the Conservator of Forests, Southern Circle, for his Museum at Coimbatore.

As already stated a large collection of grasses has been made during the year. A set of 46 species was obtained in the neighbourhood of Ootacamund for the Supply and Transport Officer, Southern Circle, Wellington, and a preliminary list of South Indian grasses was prepared at the request of the Forest Department.

Considerable additions have been made to the collection of pests and diseases during the year, but efforts in this direction have been discouraged because the staff is fully occupied with other matters.

A commencement has been made towards the formation of a herbarium of plants grown as crops. This will form an important part of our future work. Such plants as sugar-cane cannot be preserved in this way, but a series of photographs to scale and analytical drawings have been made. For this kind of work, however, an artist will be needed and descriptions of varieties will be incomplete without a simple chemical analysis.

Appendix to Botanical Survey of India Report for 1901-1902.

PASPALUM DILATATUM *Poir.*

Early in 1900 several enquiries regarding this grass were addressed to the Superintendent, Royal Botanic Garden, Calcutta, who at once took steps to obtain a supply of seeds adequate to the sudden demand. This demand was the direct outcome of certain newspaper notices in which the grass was highly spoken of as a fodder and greatly praised for its drought-resisting qualities.

The grass itself is not unlike and is nearly allied to a well-known Indian species, *Paspalum scrobiculatum*—Hindi *kodo*; best known, perhaps, in connection with the poisonous properties it develops at certain seasons and under certain conditions. So far as is known, *P. dilatatum*, which is a native of both North and South America, is free from this reproach. In America, the grass, which extends into extra-tropical latitudes, has always been held in high repute for the excellent quality of its fodder and because it keeps green during the hottest months of summer.

It was, with many other fodder grasses, introduced to Australia by the late Baron von Mueller and in the Australian colonies has found much favour owing to its hardy qualities, from the rapidity of its growth when heavy rains follow drought, and especially because of its great drought-resistance. The notices in Indian Journals were merely echoes of its Australian reputation.

In reply to requisitions addressed to them, the Government Botanists at Brisbane and Sydney were able to send small quantities of seed; other Australian officers were unable at the time to assist. As the quantity received was wholly inadequate for his purposes, the Superintendent asked the help of the Agrostologist to the United States' Department of Agriculture, who kindly arranged with a well-known firm of seed merchants (Wood & Sons, Richmond, Va.) for a substantial supply. The quantity asked for was 100 lbs. but, even from America, only 28 lbs. could be got.

Shortly thereafter the Government of India, in the Department of Revenue and Agriculture, also took the matter up and, learning that their wishes had already been anticipated, have taken a warm interest in this effort to introduce the grass on an adequate scale into India. The seed received was, in consequence of this interest, issued not only to those parties who had applied to the Royal Botanic Garden for assistance, but to others who had applied to the Government of India direct or through the Reporter on Economic Products. For this reason, and in consequence of the interest felt by Government in the subject, a *précis* of the report which parties receiving supplies of the seed were requested to send, is appended to the Report on the Botanical Survey for the year. The experiment, it may be remarked, is not yet concluded, nor have all the parties to whom seed was originally sent yet submitted reports. Moreover, the Government Botanist, Melbourne, who in 1900 was unable to help, has this year (1902) sent a large consignment of seed; this seed, with a considerable quantity harvested at Calcutta in 1901, and again in 1902, has also been freely distributed, and at least a year must elapse before the results of these fresh sowings can be stated. A sufficient number of reports has, nevertheless, been received to warrant the formation of at least a preliminary estimate of the grass as regards its suitability for India and Indian conditions.

EASTERN INDIA.—*Central Bengal.*—At Calcutta the seed was sown in the open in February 1901; only a small percentage of the seed germinated. A second trial was therefore made in March 1901; the seed was then sown in pans in nurseries. The percentage was carefully estimated; of 18,950 seeds planted, only 105 germinated, or just over one-half per cent. These plants were put out in June 1901 when the rains had set in, by which time the plants of the February sowing were in flower. The plants of the February sowing formed sparse tussocks; the transplanted plants of the March sowing, having been placed close together, formed a dense patch. In other respects the plants of the two sowings did not differ, all being equally healthy and robust and all yielding ultimately a copious crop of seed. The plot in which the first sowing was made and the pans used in the second sowing were watered daily and shaded till the seed germinated. After this no attention was given to or required by the plants; the subsequent appearance of many self-sown seedlings makes it clear that the grass is quite at home under the conditions that prevail in Lower Bengal. These conditions, however, are such that the experiment at Calcutta throws no light on the main question, the suitability or otherwise of this plant for poor or parched soils. As a fodder the grass as grown at Calcutta is excellent.

Chutia Nagpur.—Seed sent through the Director, Land Records and Agriculture, to Palamow, in Chutia Nagpur and sown in August failed to germinate at all. Seed of the same consignment, sent through the Reporter on Economic Products, to Manbhum, where the conditions are not unlike those at Palamow, did not germinate well in proportion to the bulk sown, but the plants that did come up flowered and seeded. The grass did not grow luxuriantly; indeed, self-sown plants of the native *Eleusine ægyptiaca*, which germinated along with *Paspalum dilatatum*, grew so much more vigorously that they had to be weeded out, else

the *Paspalum* could not have survived. After the rains ceased some of the plants dried up and the rest were only kept alive by watering. The Revd. Mr. Campbell, a particularly careful observer, who reports this experiment, concludes that 'it does not appear that *Paspalum dilatatum* is suited for the dry climate of Chota Nagpur.'

Burma.—The only report received relates to experimental sowings at Meiktila in May, in June and again in July 1901. Not a single seed germinated.

NORTHERN INDIA.—*United Provinces.*—At Cawnpore seed received by the Director of Land Records and Agriculture from the Agricultural and Horticultural Society of India, and sown in July 1900 did not germinate at all. Seed from the same source sown in December 1900 was equally unsuccessful. Seed received from the Royal Botanic Garden, sown in February, equally failed. The Director obtained some seed direct from the firm of P. Henderson & Co., New York, which was sown in two instalments. Of the first sowing, in September 1901, no seed germinated; from the second sowing, made in November, a few small plants were obtained, which were still alive in February 1902. About 12 per cent. of this seed germinated—7 per cent. well; 5 per cent. feebly. The experiments "did not give any good results."

Central Provinces.—Seed received by the Commissioner of Settlements and Agriculture from the Royal Botanic Garden was sown experimentally in the Sironcha Tahsil, both in the Government Garden and in low land along the river bank, but not a single seed germinated. Seed, however, that had been received from the Wellingbar Experimental Farm in November 1900 was sown at the Nagpur Experimental Farm and in the Fuel and Fodder Reserves at Nagpur which are situated on a low range of barren hills. The seed sown at the farm gave a good yield of fodder grass. That sown in the reserves germinated well, but it dried up at the same time as other local grasses. The quality of the *Paspalum* was superior to that of the native grasses. It appeared that *Paspalum* throve better on black soil than on stony hilly land; and the experiment seemed to indicate that *P. dilatatum* does not resist drought but is likely to thrive on the banks of rivers and streams where there is moisture throughout the year (*vide* Report, Nagpur Experimental Farm, 1900-1901, paragraph 20).

Rajputana.—Seed sent through the Reporter on Economic Products to Jaipur Raj did not germinate at all, though other plants and seeds got on well at the commencement of the rains which, though the monsoon ultimately failed, were at first normal.

Punjab.—A quantity of seed was sent to the Director of Farms, Punjab Command. This was sown at Jullunder, Ferozepur, Multan and Dera Ismail Khan. It failed to germinate in any place.

Seed sent to the Superintendent of the Hissar Cattle Farm sown in March 1901 did not germinate at all. Part of the same seed was sown in the garden attached to the office of the Director, Land Records and Agriculture, Punjab, in the same month in land twice ploughed and carefully watered before sowing. At first it was feared it would not germinate as the seed lay dormant for over a fortnight, but it ultimately came up after receiving four waterings at intervals of eight days.

The land on which the seed was sown was of the poor quality known as *Kalrati* (clayey) soil impregnated with saline matter. Four plots were set apart for the *Paspalum*, two of them being manured and two of them not. On one of the manured plots the grass grew abundantly, attaining a height of four feet and spreading well. On the other plot which was very saline it did not germinate at all. One of the unmanured plots which was little affected by salts gave as good results as the corresponding manured plot; on the other which was very saline the grass did not grow at all. The roots in both the manured and the unmanured plots in which the grass throve, went 10 inches into the soil and took firm hold of the ground. The grass gave an excellent fodder. These Lahore experiments "seem to show that the grass will not thrive at all on salty soils, but with care in watering it thrives well in clay soils, if not very decidedly impregnated with salts."

The Officiating Reporter on Economic Products early in 1901 visited the Government Farms at Allahabad and Cawnpore and the experimental garden attached to the office of the Director, Land Records and Agriculture, Panjab, at each of which he saw *Paspalum dilatatum* growing. At Allahabad the grass had been sown right and left of a drain which brings it abundant water and a considerable amount of manurial matter. Where the overflow of the drain reaches it the *Paspalum* is very dense and grows to the exclusion of every thing else; where the water-supply does not reach it the growth is miserable and apparently very slow.

At the Government Farm, Nawabganj, near Cawnpore, the *Paspalum* had been planted on a plot where it obtains irrigation. The plants were small and appeared unlikely to cover the ground for a long time. Both at Cawnpore and at Allahabad it was observed that where the grass was exposed to the sun the shoots of small plants tended very much to lie along the ground so as to the give breadth without depth.

At Lahore the grass was grown under irrigation and partially under shade. It formed a dense and deep bed, but the tussocks did not touch so that there was some loss of space; suggesting that the most remunerative place for growing the *Paspalum* might be in a grass mixture with other fodder plants to fill the waste corners between the *Paspalum* tussocks.

Mr. Burkill concludes his interesting note by expressing the opinion that in India the grass will not become established unless it can obtain a large water-supply, and he doubts very

much "if it will be found to maintain itself in the drier parts of India, when established, unless irrigated."

WESTERN INDIA.—Seed sent to the Director, Land Records and Agriculture, Bombay, was sown at Deesa, both on manured and on unmanured ground, but failed to germinate in both cases. The ground was not watered but good rain fell on it a few days after the seed was sown. On the Poona Farm a few seeds germinated, but the plants have not flourished.

SOUTHERN INDIA.—*Coorg.*—Seed sent through the Reporter on Economic Products to Mr. P. G. Tipping, Sidapur, was tried on a piece of land from which *Lantana* had been cleared, but none came up. In marked contrast to this was the experience with part of the same consignment of seed sent direct to Mr. G. L. Newbery, Pollibeta, South Coorg, who planted some seed in virgin soil and some in very barren and dry soil, similar to that of the Mysore plains. Both lots came on very well indeed and throve equally. Some seed was also scattered broadcast in the jungles; that grew well also. The seed was put out in September 1901, the altitude of the place of experiment being 3,022 feet, the average rainfall 53 inches. No water was applied to encourage growth when the hot weather set in, nor did the grass seem to require much water. In North Coorg at a greater elevation and with an average rainfall of 120 inches it was said not to be a success, but in Mysore, 20-30 inches rainfall, it did well. Mr Newbery states that cattle are very fond of the grass and that it seems much hardier than Guinea grass, and is inclined to give a more luxuriant crop during the dry season.

The manager of the Saidapet Farm sowed *Paspalum* seeds received in June 1900 in a small bed; transplanting half to another plot after two months, the remainder after about a year. The grass did well under irrigation. The grass at Saidapet did not appear to possess any advantage over Guinea grass.

The Conservator of Forests, Northern Circle, Madras, furnishes an interesting *resumé* of the results obtained by the District Forest Officers of Bellary and Ganjam. In Bellary the seed failed to germinate. In Ganjam seed sown at Chatrapur, in a bed of sandy loam, in July, failed to germinate. Seed sown in pots, however, germinated exceedingly well and on the pots becoming crowded with the grass, the plants were put out. The contents of one pot transplanted into a patch of ordinary indigenous grasses all died; this was supposed to be owing to their not having been watered. Another lot of plants, put out in two beds in the nursery at Chatrapur, and all the plants left in pots throve well. The plants in the beds and pots were watered daily. At Agustinogam, where the rest of the seed sent to Ganjam was sown, the results were as follows:—Seed sown in a bed in the nursery in good soil germinated well. The plants were afterwards transplanted to other beds and produced seeds which when sown also germinated well, and all the plants so obtained have since thriven perfectly. Some seed was sown in a patch under Casuarina trees 10 years old, the soil being pure sand with a covering of dead Casuarina twigs. The ground was slightly hoed without removing the dead leaves. The seed germinated well; subsequently the plants were transferred to the nursery beds. Finally, two small patches of pure sea shore sand were enclosed in a fencing of Casuarina branches six feet high so as to protect the plots from the sun. In these plots the seed was sown broadcast and no other soil was added. The seed germinated well, but the plants, with the exception of a few sickly specimens, seemed to die off though they were watered daily. After a considerable interval a certain number of the sickly surviving plants became healthy and quite green so that it is hoped that if, by watering, they survive the hot weather, they may afterwards survive without watering. The plants form scattered tufts.

The Honorary Secretary, Madras Agri.-Horticultural Society has very obligingly furnished a report, embodying the experience of several parties to whom the Society forwarded seeds. At Old College Park the grass was by no means a success. The seeds did not germinate for two months and then did so only sparingly. At Ootacamund the grass proved decidedly valuable at 5,600 feet elevation. The seed was rather difficult to germinate and the same correspondent found some seed, independently obtained by him, a failure. At Virrudupattee the seed did not germinate at all. At Adyar the seeds came up but did not mature. Grown in a flower-pot the success was rather greater, but the plant was not a good drought resisting fodder. At Sivaganga the points noticed were (1) that the seed is long in germinating, (2) that the growth is stunted and poor unless the plant receives as much water as most other fodder grasses require, and (3) that grown along side of *Pennisetum cenchroides* and under similar conditions, *Paspalum* is much inferior both in facility and in luxuriance of growth. On the Kainia Betta estate, South Coorg, the seed was put down in the dry weather and made very slow progress although watered and looked after. In the wet season a number of plants were put out as Guinea grass is and did well. But it seemed doubtful if it had any advantage over Guinea grass or indeed if it were as good. The only point in its favour would be that it should grow during the long dry weather, which Guinea grass will not. But there was rain in December last in South Coorg, so that it is premature to say what its drought resisting powers may be. At Bangalore half the seed was planted in the open on carefully prepared fenced land. None of this seed germinated, most of the other half of the seed, sown in good soil in flat pans and carefully watered and shaded, germinated but the resulting plants grew slowly. They were transplanted during the rains to a piece of ground raised in ridges. Here the *Paspalum* subsequently did fairly well, but it appeared certain that without attention and if left unwatered it must have perished. The conclusion formed at Bangalore is that *Paspalum dilatatum* has been greatly over-rated; that unless carefully attended to, it will be unsuited for India as a fodder-grass; that it is not to be compared for usefulness

with the well-known *Cynodon dactylon*, the *Hariali* of South India, or *Dub* of North India, which as a fodder-plant in India cannot be equalled and which, if only given a fair chance and not rooted out of the ground, as the custom in India is, during the dry weather, is capable of propagating itself by its widely spreading roots.

At the Agri.-Horticultural Society's Gardens in Madras some of the seed was sown in beds and very carefully attended to, but barely 1 per cent. of the seed germinated. At the same time seed was sown in flat pans. This germinated well and the plants were treated as ordinary annual seedlings, being first pricked off into pans, three weeks later transferred to 3 inch pots, finally put out into prepared beds and carefully watered. Under this treatment the grass did very well and the plants formed large tufts which were in September 1901 divided up and partly transplanted, the surplus being distributed. Plants left unwatered were of hard and stunted growth. The plants at Madras flowered in November 1901 and seeded freely, but this seed failed to germinate.

In the Annual Report on Government Gardens and Parks in Mysore for 1900-1901, page 10, Mr. J. Cameron refers fully to this grass. Seeds were received from the Madras Agri.-Horticultural Society, from Trivandrum, from the Government Botanist, Melbourne; some seed was also purchased from the firm of Somner & Co., Melbourne. (The Madras seed came from Calcutta and was of American origin, so that the Mysore experiments were conducted with both American and Australian seed.) Cultivation in the Lal Bagh and the Palace Gardens was encouraging, and seed was gathered from the first crop. With manure and irrigation a single crop of green grass, averaging 12-15 tons per acre, could easily be raised. Such a crop takes 2½ to 3 months to grow. Grown in the rainy season without manure or irrigation, at least half the above out-turn might be expected. The result of leaving the grass to its own resources during the dry season had yet to be recorded when the report was written. But with regard to the question of its value Mr. Cameron quotes the guarded statement of Dr. Luehmann, the Government Botanist at Melbourne, made when presenting a quantity of seed:—"It is no doubt a very useful grass, but whether it will come up to the extravagant expectations entertained about it may well be doubted."

This *resumé* of results so far obtained shows very clearly that there is a great initial difficulty in getting the seed to germinate. This difficulty has been experienced both with seed of American and of Australian origin, and that it has been due to no special defect in the quality of seed imported by the Superintendent of the Royal Botanic Garden is evident from the experience of the Director of Land Records and Agriculture, United Provinces, and of the Superintendent of Government Gardens, Mysore, who obtained also independent supplies of seed from America and Australia respectively. It is still more evident from the fact that when treated with special care, as at Calcutta, at Lahore, at Madras, and at Bangalore it was got to germinate. The seed evidently takes a considerable time to germinate, and is thus, except under special conditions, apt to be a complete failure. This discouraging result must not, however, be assumed, by those who have failed, to indicate that the seed supplied them was bad; nor must it be assumed, by those who have succeeded in raising plants, to indicate any want of care or undue impatience on the part of those whose results have been negative. The latter may, however, in the light of the experience here recorded, be encouraged to try again. The results obtained by Mr. Newbery in South Coorg, which are in striking contrast to those of all the others who have been good enough to supply information, really only prove what has been said; by some happy accident the conditions under which the seed supplied to him was sown were those that suited the grass, so that he obtained, without trouble, the results that at Calcutta, Madras, Lahore, and Bangalore have only been realised by giving special care and attention to the seed.

As regards its drought-resisting qualities everything so far goes to show that they are, under Indian conditions, of the slightest, and that the outcome of our efforts has merely been the introduction to India of a new fodder of excellent quality which will thrive well in regions where, and in seasons when, fodder is plentiful in any case. But we have not in *Paspalum dilatatum* obtained that ideal plant, whose attributes, if considered soberly, are practically a contradiction in terms; a fodder that will grow in times of famine and in seasons of scarcity.

D. PRAIN.

G. I. C. P. O.—No. 535 R. & A.—1-8-1902.—360.—C. W.

Report of the Director of the Botanical Survey of India for the year 1902-03.

1. *Survey of Eastern India.*—The allotments provided for Botanical Surveys in Bengal, Assam, and Burma have been expended in full. In Bengal the Director, through the courtesy and with the assistance of the Conservator of Forests, Bengal, was enabled to make a personal tour in the Sundribuns, a forest tract of much interest and value, during the latter part of July and the early part of August 1902, with the result that it was possible to prepare for the Records of the Botanical Survey an account of the vegetation of the region that, it is hoped, may prove of use to the various officers of Government in charge of it. In Sikkim, collections were made by the Curator, Lloyd Botanic Garden, Darjeeling, and by trained Lepcha collectors. In Chota Nagpur, the Commissioner of the division most kindly supervised the work of a native collector in the Tributary States, with the result that very considerable additions were made to our acquaintance with the vegetation of the region.

In Assam, the services of a native collector were utilized for part of the season in the Assam valley, while during November and December 1902 it was possible, through the kind co-operation of the Superintendent, Lushai Hills, to depute the Assistant Curator of the Royal Botanic Garden to make a botanical collection in the North Lushai Hills, a region regarding which hitherto little was known botanically. In Burma, the Curator of the Calcutta Herbarium was deputed to make a systematic study of the vegetation of Minbu, a district typical of the desert zone in Burma, our knowledge of which has hitherto been very inadequate. During this visit the Curator received much assistance from the local officers at Minbu, and particularly from the Superintendent of Land Records there. The services of native collectors were utilized prior to this deputation and as ancillary to this investigation in the districts of Minbu and Myanaung. The results both of the Lushai and Minbu deputations promise to be of great interest.

2. *Survey of Northern India.*—During the early portion of the year the services of native collectors were utilized in providing material for the completion of Mr. Duthie's *Flora of the Upper Gangetic Plain.*

3. *Survey of Western India.*—The chief botanical survey work of the year was done on the Western Ghats by the officer in charge of the survey and his Herbarium Assistant; native collectors were also sent to various localities in order to obtain material illustrative of particular species dealt with in the *Flora of the Presidency of Bombay.*

4. *Survey of Southern India.*—The main botanical survey work of the year was done in the Godaveri gorges.

5. *Publications.*—The two parts of *Records of the Botanical Survey of India*, volume II, which were in the press at the close of the preceding year, were issued on 15th August 1902. The first, entitled *Plants of Chutia Nagpur*, by Lieutenant-Colonel J. J. Wood, I.M.S., provides a useful hand-list of the species hitherto reputed for that important province; the second entitled *A note on plants used for food during famines and seasons of scarcity in the Bombay Presidency*, by Mr. G. A. Gammie, F.L.S., gives a convenient *résumé* of all the information available on this subject. A third part, a *Systematic enumeration of the species of Calamus and Dæmonorops*, by Signor O. Beccari, is a most valuable guide to the various species of rattans and canes; this was issued on September 27th, 1902. Two other parts were completed and sent to press during the year, but had not been issued at its close. The Director also prepared during the year an account of *Qát, or Arab Tea*, and various other papers.

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The *Flora of the Bombay Presidency*, by Dr. T. Cooke, continues to make steady progress, part III, completing volume I having been published. The *Flora of the Upper Gangetic Plain* has also made substantial progress, volume I having been completed before the close of the year though its issue had not then taken place.

6. *Economic and Agricultural Botany.*—The continued attention of the Director has been given to economic and agricultural questions. The investigation of the Indian yams has made steady progress, and now approaches completion. It has involved the necessity of asking for assistance and material from Ceylon, Malaya, and China in order to render the results of the enquiry accurate and, as far as possible, complete; the Director of the Survey and the Reporter on Economic Products, in whose hands this investigation conjointly is, are much indebted for great and readily granted assistance to the Directors of the Botanical Gardens at Buitenzorg, Peradeniya and Hong-Kong. There appears to be no little confusion in the fibre trade regarding the sources of the fibres vaguely classed as Indian Hemp: the questions that have arisen can only be settled by the cultivation and identification of the plants yielding the various fibres as classified by dealers. This is accordingly being systematically done. A collection of specimens of plants from Africa yielding Indigo are being submitted for report. The examination of these will be taken in hand by the Director on their arrival. In connection with this subject, the Director visited Behar in August 1902, and the Curator of the Herbarium was deputed, in September and October 1902, to investigate along with the Biologist to the Bihar Planter's Association the sources and nature of the Indigo seed supply in Upper India. Numerous minor economic questions have been dealt with during the year. The economic enquiries undertaken in Western and Southern India are fully dealt with by the respective officers in charge, whose reports are submitted in original.

7. *Staff.*—The Director was in charge of his post throughout the year. The Director of the Botanical Department, Northern India, Mr. J. F. Duthie, retired from the service of Government on 31st December 1902, and the post held by him was abolished with effect from that date. The Herbarium of the Department has been placed, *pro tempore*, under a care-taker over whose work the Superintendent, Government Gardens, Saharanpur, exercises a general supervision. The surveys of Western India and of Southern India have been in charge of Messrs. G. A. Gammie and C. A. Barber, respectively, both of whom have done excellent work.

DAVID PRAIN,

Director, Botanical Survey of India.

Report on the Botanical Survey Operations in the Bombay Presidency for the year 1902-03, by G. A. Gammie, F.L.S., Officer in charge of the Botanical Survey, Bombay Presidency.

I held charge of the office of the Botanical Survey, Bombay Presidency, throughout the year.

1. *Tours.*—During the hot weather vacation Mr. Bhide and I travelled over parts of Belgaum, Sawantvadi and Ratnagiri. In the cold weather vacation Mr. Bhide botanized from Poona to Poorandhar; to Jeur in the Sholapur District; and also from Wathar to Mahableshwar and Pertabgarh during which journey he found a fine new species which Dr. Cooke has described as *Kalanchœ Bhidoi*. At the same time I retraversed parts of the Poona Ghats, Bhor State, Kolaba, and Thana Districts. Besides these journeys some minor ones for definite objects were undertaken by the plant collectors alone. I paid several visits to the Sisal plantation at Nandgaon and devoted much time to botanical investigations on the Poona and Manjri farms.

2. *Herbarium.*—As I mentioned in the last report, the Herbarium with its contents, was completely destroyed by fire on the 1st May 1902. Since then the building and fittings have been reconstructed, and it will be seen from the detailed list of specimens incorporated that no pains have been spared in the attempt to restore the Herbarium to its former high standard. I have to thank the following gentlemen for the assistance they have afforded me. Dr. T. Cooke, who presented the specimens forming his own Herbarium up to the end of Liguminosæ. He has generously promised to present the remainder of his Herbarium as his work on the Flora of Bombay progress. His collection is invaluable because it is named in accordance with his book.

Mr. G. M. Ryan, Deputy Conservator of Forests, Central Thana, has sent, and still continues to send, valuable sets of plants from his district. The accompanying notes are of great value, and we purpose issuing a record of the whole when completed. The Superintendent, Victoria Gardens, Bombay, has kindly sent a large set of specimens which replace many that were lost.

Mr. Woodrow sent a set of the rarer grasses and sedges which is of the utmost value to the Herbarium. Lieutenant-Colonel Jencken, R.A.M.C., was good enough to give us a small set of Nilgiri specimens, and Mr. V. R. Damle sent interesting plants from Kolaba.

The following is the year's record of specimens incorporated in the Herbarium:—

Specimens collected by Mr. G. A. Gammie	5,806	sheets.
„ „ „ „ R. K. Bhide	1,568	„
„ „ „ „ L. D. Garade	2,630	„
„ presented „ „ V. R. Damle	47	„
„ „ „ Dr. T. Cooke	2,891	„
„ Herbarium, Botanic Garden, Calcutta	110	„
„ presented by Mr. G. M. Ryan	553	„
„ „ „ „ G. M. Woodrow	157	„
„ „ „ Lieutenant-Colonel Jencken	22	„
„ „ „ Superintendent, Victoria Garden, Bombay	398	„
TOTAL	14,182	„

3. *Publications.*—A note on the Plants used during famine and times of scarcity was published as a contribution to the Records of the Botanical Survey of India. A botanical account of the Indian wheats grown at the Poona and Manjri farms was despatched to the Inspector General of Agriculture in India, and a similar account of the cottons is almost ready.

4. Owing to the loss of my records I was unable to complete the reference to *Catha edulis*, but, by the kindness of the Director of Land Records and Agriculture, I am now able to do so from fresh copies of the correspondence on

the subject. As so little is known of the plant in India, to obtain fuller information, I drew out the following list of questions which were answered by the courtesy of the Political Resident, Aden :—

1. Where is it grown and how ?

   It is grown on the mountains of Yemen. It is brought to Aden from the Turkish District Makatra, situate to the north and west of the Subaihai country under British protection.

2. What are its requirements as regards climate and soil ?

   Where coffee grows the plant will thrive. Some years ago good coffee berries from Yemen were sent from Aden to the Victoria Gardens, Bombay, where the plants are thriving well and some coffee is collected from them.

3. If it is a cultivated plant, where did it originate ?

   It is not known where the plant originated.

4. Is the plant subjected to any particular cultural treatment ?

   It is planted from cuttings, and after it takes root it is transplanted once or twice and then finally planted in the places required. It is said that it grows like the Indian tamarind tree. As often as the leaves sprout the plant is trimmed. The tender twigs with leaves are cut as the plant grows.

5. How often are the leaves collected in a year, and are old or young leaves made use of ?

   The tender twigs with leaves are cut as often as required and the rest allowed to grow to a tree. Only young leaves are made use of.

6. What is the process of manufacture ?

   There is no process of manufacture. The fresh leaves are chewed and are said to produce great hilarity of spirit.

7. How is it prepared or packed for export ?

   Small bundles are made consisting of about 30 or 40 twigs, which are wrapped up in twigs and leaves of the kât tree or other plants.

8. Whence is it shipped or transported ?

   It is imported from places near Aden and sold here.

   It is also exported to ports on the Arabian and African coasts.

9. How is it used for drinking ?

   It is not used for drinking since the use of coffee has become general.

An excellent account of kât, which is often quoted, is published in the historical account of Aden, by Captain F. M. Hunter. On sending samples of kât to Mr. D. Hooper, the Curator of the Economic and Art Section, Indian Museum, Calcutta, that gentleman generously furnished me with the following particulars :—" Albert Beither finds that the previously described alkaloid *katine* is associated with a new caoutchouc substance $C_{10}\ H_{17}\ O_1$, which softens at 50°C., and melts at 120°C. Traces of a volatile oil lighter than water, which darkens on keeping, ultimately depositing crystals and has a powerful odour, were also obtained. The alkaloid is present in only a very small quantity. The leaves from Aden yielding only 0·076 per cent., while those from Harrar yielded only half as much. It is purified with difficulty and gives precipitates with the usual alkaloidal reagents, but only when present in fairly strong solution. (Arch. de Pharm 239, Feb. 8, 1901.)"

5. *Sisal Hemp.*—The 11 plants, which flowered the previous year, produced nearly 20,000 bulbils, of which over 12,000 were despatched to the Divisional Forest Officer, Nasik, and the remainder were distributed to various applicants for experimental purposes. During the year under report, 16 plants flowered and they have produced 38,800 bulbils.

The plants put out in the Botanic Garden, Ganeshkhind, made fair progress, and those at the experimental plot at Nandgaon are also in a thriving condition.

6. *Sabai grass.*—No application for seed was received during the year. The Managing Agents of the Reay Paper Mills have decided to grow the plants without irrigation, so that now the plant only yields one crop per annum. On irrigated land the difficulty regarding the flower-stalks appears to be insurmountable.

The plants of *Esparto* (Stipa tenacissima) remained small and never recovered from the effects of the hot weather. The plant is thus manifestly unsuitable for cultivation at Poona.

7. *Economic work.*—The examination of the wheat and cotton varieties was continued. During the present year I hope to come to some definite conclusion regarding the classification of the *Jowars* and some minor crops. Two interesting discoveries among the latter were a peculiar form of *Múg* (Phaseolus Mungo *Linn.*) from Guzerat and a luxuriant form of *Panicum ramosum* Linn., which is cultivated as a cereal in one taluka of Ahmednagar.

I have to thank Mr. R. K. Bhide for his cheerful assistance in the Herbarium and field. Mr. L. D. Garade, who succeeded the late Mr. Madane as Head Plant Collector, took entire charge of the preparation of the very large number of specimens and by the exercise of unremitting industry, he avoided any accumulation of arrears. Mr. L. Khomne has taken up the duties of Second Plant Collector which he has performed to my entire satisfaction.

GEORGE A. GAMMIE,
In charge of the Botanical Survey of the Bombay Presidency.

POONA;
The 2nd July 1903.

Annual Report of the Government Botanist, Madras.

I have the honour to forward the following report of the work of my office during the year 1902-03.

2. Owing to the transfer of my head-quarters to Madras the ordinary course of touring was considerably interfered with. The following were the chief places visited:—

Ootacamund.—This was my head-office until 1st July and some two months were spent there in arranging the collections for the transfer.

Madras.—After 1st July my office was located in the Board's buildings at Chepauk. For reasons given below, only two months of the remaining nine were spent in Madras, the rest being devoted to travelling.

Samalkot.—Nine visits were made during the year to the experimental sugar station. The longest of these was for the month of March during which the crop was reaped.

Coorg.—The first half of June was spent, chiefly at Fraserpet, in the investigation of the sandalwood disease known as "spike."

Kistna District.—A general agricultural tour was made through the dry taluks of this district, from the end of September to the beginning of November.

Godavari gorges.—A plant-collecting tour was made up the river during the latter part of November and the first half of December.

South Wynaad.—A fortnight in January was devoted to a tour through the planting districts of the Wynaad, most of the time being spent in the investigation of the pepper disease.

3. An important change was made during the year in the work of the Government Botanist. By G. O., No. 292, Revenue, dated 25th March 1902, he was transferred to the Agricultural Department and his work became mainly economic. As a consequence of this, his office was moved from Ootacamund to Madras. The collections were safely transmitted at the end of June. The rooms in the Board's offices are ill-suited for microscopic and general laboratory work, and, pending the erection of suitable quarters, the Government Botanist found it advisable to spend a considerable part of the year on tour.

4. The only tour devoted definitely to the botanical survey was the short one in the Godavari gorges. The dry flora along the banks of the river were carefully collected, and a number of species were also obtained on a five days' trip among the evergreen forests of the Eastern Ghats near Bison Hill.

Besides this main tour, smaller collections were made in the Kistna District, in Coorg, around Coonoor and Ootacamund, at Gudalur, in the Wynaad and down the Tambracherry ghat. No great effort was, however, made to increase the collections, since the preparing work was completely disorganised by the removal of the herbarium.

5. A commencement was made towards collecting a fungus flora of the Presidency, the Cryptogamic Botanist to the Government of India having expressed a desire for Madras specimens. Thirty-two collections were made and forwarded to Dehra Dun during the year.

6. Among the numerous specimens received for identification, five parcels of grasses were sent in by different Forest officers. The work of naming these is proceeding, but little progress has been made in this direction because of other work. About 130 sheets of grasses have been named during the year and 500 more await attention.

A collection of 102 sheets of plants was received from Calcutta, but, owing to press of work, none have been sent in return. About 250 sheets have, however, been prepared for this purpose and will be forwarded as soon as they can be dealt with.

7. On the initiative of the Officiating Reporter on Economic Products to the Government of India, considerable attention has been paid to the different

varieties of sorghum grown in the Presidency. Altogether 94 sets of sorghum heads have passed through the office for transmission to Calcutta, duplicates being retained in all cases for future reference.

8. The Superintendent of the Royal Botanical Gardens in Calcutta and the Reporter on Economic Products having decided to work up the varieties of yams, wild and cultivated, throughout India, the somewhat delicate task of forwarding living specimens of the tubers for growth in the Calcutta gardens devolved on this office. Fifty baskets of these have been despatched during the year. The importance of having such sendings passed through a Central office may be gathered from the fact that many have had to be rejected because of small size, decay *en route*, or because they were not yams at all but tuberous plants of other orders.

9. An attempt has been made to collect information regarding the wild indigos of the Madras Presidency. It is supposed that among these there is one at least of great economic value, and the search has been commenced for it. A number of plants have already been received in this office, but, since their state of preservation on arrival has been almost uniformly bad, little progress has been made in the enquiry. Such indigos as the Government Botanist was able to collect on tour have been carefully examined and sent for checking to the Superintendent of the Royal Gardens in Calcutta, and several interesting species have been found among them. The cultivated forms so far collected have been uniformly referred to *Indigofera sumatrana*, and not to *Indigofera tinctoria* as had been supposed.

10. The sandalwood plantations of Mysore and Coorg have recently developed a new and alarming disease called "spike." In this the plant slowly or rapidly alters the character of its foliage, the leaves becoming smaller and less numerous as the disease advances. Ultimately the affected plant dies out altogether. Large areas where the sandalwood was formerly abundant are now completely devoid of these trees, the disease having made a clean sweep of them. The sandalwood of commerce is entirely collected from dead trees. While therefore the visible supply is not likely to decrease during the next few years and might indeed be greatly increased with little difficulty, there is some prospect of this profitable source of revenue being lost to the State. Considering the importance of the product, the Government Botanist was lent to the Government of India to examine the plants *in situ*. No trace of any parasite was found in the tissues, but a number of interesting facts were brought to light in the investigation, the report on which was reproduced in the *Indian Forester*.

11. A fortnight was devoted to an examination of the pepper plantations of the South Wynaad. After some years of phenomenal success, many of the vines are seen to be dying out. A number of diseases were met with, but there was no *one* which was universally found. The plants were extremely liable to cankerous growths, and in some cases severe attacks of eelworms on the roots were met with. In certain vines a hyphal infestation was found throughout the vessels in the fibrovascular bundles, but the presence of this fungus did not appear to have any relation to the relative "sickness" of the vines. A preliminary report was issued and the investigation postponed until the Government Botanist should have the opportunity of examining the plants during the dry weather.

12. The cockchafers of the Nilgiris continued to receive attention, although the completion of the work was interfered with by the removal of the Government Botanist's office to Madras.

13. By far the most important economic work of the year was that in connection with the Samalkot experimental sugar station. The complete management of this passed into the Government Botanist's hands on 28th April, and throughout the year its affairs have occupied much of his time.

In spite of the hurried manner in which the land was acquired, and the lateness of the time of planting, the year's work may be considered generally as successful. A change was unfortunately necessary in the Agricultural Inspector in charge, and the land proved in most cases to be in very poor physical condition, but the growth of the canes was, on the whole, satisfactory. Some of the fourteen varieties showed remarkable growth, and the results obtained from the

"methods" plots were interesting. The manurial plots were, on the other hand, of little value, in that the physical condition of the soil was quite unfit for this line of work. A second large piece has been taken up, a number of varieties have been added to the station, the manurial experiments have been simplified, while the different methods of growing the cane have received far greater attention. At the close of the official year the whole station was planted up, and over 100 experiments were being carried out in sixty separate plots. The work of reaping the crop and planting the station up was very heavy, and the bulk of the office staff were employed during the month of March in the necessary counting and weighing operations. The varieties grown were analysed through the kindness of Messrs. Parry & Co. at the Deccan Factory. As was perhaps to be expected at first, the local varieties proved to be superior to those introduced from Bombay and elsewhere. The unoccupied land was laid out in paddy of which several varieties were tried. At the instance of the Deputy Director of Agriculture the short "two-months" paddy of the Tanjore District was successfully introduced and the seed sold to the ryots.

14. A short visit was paid to the sugarcane experimental garden at Vizianagram. Here a number of Mauritius canes have been grown for several years in comparative isolation. These were inspected, and the planting for the current year was superintended by the Agricultural Inspector stationed at Samalkot. By the kindness of the authorities nine of the varieties were planted at Samalkot and subjected to a preliminary analysis, forming a valuable addition to our set of varieties there. It is proposed to pay occasional visits during the year to this interesting little garden.

15. An important innovation in the usual touring arrangements was made, in that a tract of country was selected for detailed agricultural examination. The Government Botanist toured for about six weeks through the upland taluks of the Kistna District, studied the crops and modes of cultivation and collected examples of the various pests.

The chief crops thus submitted to detailed study were indigo, chillies, cotton, cholam, maize, tobacco, dry paddy, sazza, korra, white variga, the various grams and other crops were also noted where met with. It is proposed to devote one tour each year to the study of the crops of a district in this manner.

Among the many fungus and insect pests collected during this tour, perhaps the most interesting was a Colletotrichum so closely allied to the existing species attacking the sugarcane that it was not possible to distinguish the two under the microscope. It was abundant on dying cholam leaves and appeared to be saprophytic. It is probably widely distributed, and, if so, attempts to stamp out the sugarcane disease must take the proximity of cholam into account. The matter has been referred to the Cryptogamic Botanist to the Government of India. Most of the remaining pests have been merely "recorded" in the office collections until such time as may allow of their being worked out in detail.

16. During the year under review the following additions were made to the office staff. An entomological assistant, an artist, an additional plant-collector and an extra peon. These officers, who joined at the commencement of March, were employed during that month at the Samalkot sugar station, the artist making careful paintings of all the varieties of sugarcane grown.

17. No useful purpose would be served by giving references to the many minor matters which have engaged the Government Botanist's attention during the year. Suffice it to say that the number of subjects brought before him was far in excess of what could be properly dealt with, and the wideness of the field of study has never been more keenly felt than during the period under review.

Appendix to Botanical Survey of India Report for 1902-03.

PASPALUM DILATATUM, *Poir.*

A number of reports on the cultivation of this grass having been courteously forwarded by various correspondents during the year 1902-03, a *resumé* of the further experience thus recorded is given in continuation of the appendix to the Annual Report of the Botanical Survey for 1901-02.

The seed supplied for these experiments, it should be premised, was obtained from Australia in two consignments, one packed in a bag, the other in a zinc-lined case.

Punjab.—Seed sown on the military grass farms at Umballa and Mian Mir failed to germinate at either place.

Burma.—Seed of both kinds sown at Mandalay were equally a failure although the Deputy Commissioner made several attempts to raise them. Seed sown in the open did not even germinate.

United Provinces.—Both kinds of seeds were tried both in the rains and in the cold season, but failed to give anything like satisfactory germination. Some seed received from America, after several trials and with great care and attention, germinated on one plot at Cawnpur. By frequent waterings it was kept in existence for two years, but never produced any fodder worth considering. The Deputy Director of Land Records who supplies the information gives it as his opinion, without hesitation, that as a fodder for the United Provinces *Paspalum dilatatum* is worthless.

Bombay.—The Inspector General of Supply and Transport, Bombay Command, reports regarding the experimental cultivation of *Paspalum* in the Mhow and Deesa Commands.

The seed sown both at Deesa and at Ahmadabad failed to germinate. Ten pounds of seed imported from Australia by the General Officer commanding the Mhow District gave very good results. At Mhow this seed germinated thoroughly when watered by hand labour. Though the seed was sown late in the season owing to the late monsoon the crop was fit for cutting by the middle of September, but was left in order to obtain seed for further propagation. The crop was covered with old chopped broken hay to protect it from the scorching heat of the sun and by this means was kept green without any watering. This, the General Officer Commanding the Mhow District, adds, "undoubtedly proves that it is one of the most drought-resisting grasses." The Supply and Transport Officer, Nasirabad, reports that seed sown in manured and irrigated ground germinated well, but seed sown in unirrigated and unmanured land did not germinate at all. Growth was fair but irregular, a good deal of the grass dying off and leaving the field patchy. The grass was cut and issued green during September, an average period of 80 days; under better conditions it would have been ready for cutting some days earlier.

The officer of the battery to which it was issued thought well of it as a fodder. The yield was equal to 5,882 lbs. green grass, or 3,000 lbs. hay per acre, the usual rate of hay for Nasirabad being 1,000 lbs. per acre. This officer further reports the experience of others in Nasirabad with *Paspalum*. In 1901 some seed received by the Cantonment Magistrate was sown (*a*) in his own garden, (*b*) by the Mission, and (*c*) in the Commissariat garden. The sowings (*b*) and (*c*) were failures, the seed not germinating. The sowing by the Cantonment Magistrate himself was a success, three crops having been cut from the grass during the rains and cold weather. The roots were subsequently given by the Cantonment Magistrate to the Suppl. and Transport Officer who planted them on poor soil, lightly manured but liberally watered. The grass grew vigorously and was cut in the beginning of October to save the seed which was ready for collection though the grass itself was still green. The interest of this experiment lay in its showing that the grass of the second year was of more vigorous growth, and much richer in colour, than the grass raised from new seed. Whether this was due to acclimatisation or to the soil (kunkur) being more suitable was not clear. The outturn in this experiment was equal to 7,616 lbs. of green grass per acre.

Another officer at Nasirabad imported fresh seed and put it down in his compound; the land was softened by ploughing but was not manured. Though watered, very little of the seed germinated and the plants withered very soon.

On the Military Dairy Farm the seed completely failed to germinate.

The conclusion come to by the Supply and Transport Officer, Nasirabad, on these experiments deserves to be given in full. "From these trials," he says, "it appears that the seed when freshly imported will not always germinate if either too wet or too dry, and that there is a large percentage of failure in what does germinate; that acclimatised roots can be transplanted and do well, none failing if sufficiently watered; also, that the crop is better in quality and heavier in the second year."

Andamans.—A report has been forwarded by the Superintendent of Port Blair embodying the opinion of the Executive Commissariat Officer there, who reports that, although the seed sown in 1901 had germinated, the result was disappointing, the grass only reaching a height of

12 to 18 inches, and being of poor quality. Cattle fed with it did not appear to eat it with the same relish as they did guinea grass. The seed sown in 1902 is reported as having failed to germinate at all.

Madras.—The Conservator of Forests, Northern Circle, has forwarded a note on the experiments made with the seed of 1902. In Ganjam the seed was sown under various conditions but except some 20 seedlings in a flower-pot none germinated. In Godavari the seed was sown in four beds, soil similar in all, but two in shade, two in the open. After 3 days' consecutive rain the seed was sown; that in the beds in shade germinated, that in the beds in the open did not germinate at all. The growth was good, the maximum height being 3 feet; flowering took place in September and seed was collected during October and November. In Kistna there seemed to be no difference between the seed that had come in a bag and that received in a zinc-lined case, both kinds germinating equally well. Most of the seed was sown in July in raised beds of sandy soil which had been manured. Germination commenced in 5 days and continued for a month, a large percentage germinating. Some seed sown in unprepared beds of sand germinated poorly, some of the seeds germinating as late as in December 1902. The grass in the better soil flowered towards the end of August; the growth was luxuriant and yield of seed fair. In the beds of nearly pure sand the growth was poor and flowering meagre. All the beds were steadily watered. Half of the prepared beds were in the open, half under shade; the germination in the shaded half was rather more plentiful, the maximum height was 30 inches. In the unprepared beds the growth was insignificant, the plants spreading along the ground. Some seed was sown on ordinary soil in Khanakhallu reserve on 28th August 1902. On 22nd November about 16 plants only were found growing spread along the ground, so that the germination here had been poor. In Bellary the beds for sowing were made under shade, the soil well worked but not manured. Of the four beds, two were inside the nursery, here the seed received in a zinc-lined case was sown; two were outside the nursery and in these the other seed was sown. The seed germinated in all, but the seed received in the zinc-lined case did so more vigorously and profusely. The plants of both kinds subsequently grew well. In Anantapur both kinds of seed were sown broadcast in the District Forest Officer's Bungalow Compound. Both kinds germinated equally well, about 30 per cent. in each case. Seed sown in two beds in inferior soil and in a more exposed position almost failed to germinate at all, though the few plants that did appear have done well. In the Upparapalli reserve two beds were sown broadcast in the open, and here again about 30 per cent. of each kind of seed germinated, the plants subsequently growing vigorously. No appreciable difference has been observed between the plants raised from the two sets of seeds except those from the seed received in a bag appeared to be greener than the others. In forwarding these reports the Conservator of Forests, Northern Circle, remarks: "I understood that *the* great feature about this grass was that it could withstand drought and do without watering, but this does not appear to be the case at all, and in fact the whole experiment seems to be a very doubtful success."

Bengal.—The Commissioner of Chota Nagpur reports that some of the seed sent to him was sown in a box, the rest in two beds in the open, one bed in shade, the other not in shade. The seeds in the open germinated very poorly, in the box very fairly. The seedlings in the box were transplanted, some to a bed under shade, the rest to a bed in the open. Up to the end of December the four beds were regularly watered, otherwise the plants would not have lived. After the beginning of January the plants were not watered but at the beginning of May 1903, they were still healthy enough except in one of the plots in the open where very few remained alive. The Commissioner, who took great pains over the experiment, concludes his report as follows: "Personally I think that the trouble and the watering needed to keep the plants alive during the past year, make the grass quite unsuitable for this Division." In the Royal Botanic Garden at Shibpur, where the conditions are those typical of the Lower Gangetic Plain, no attention was bestowed on the grass as regards its cultivation, because none was necessary. It yielded a very large supply of excellent fodder, which was used to feed the garden cattle who ate it readily, and it afforded an abundant supply of seed. Many stray tussocks are now appearing spontaneously at considerable distances from the plots in which it was originally sown. The quantity of green fodder yielded was much greater than it was during 1901-02, and the growth of the plants during the past year has been more vigorous. The species is in fact satisfactorily established. But while this is the case it will be seen from this year's reports on the subject that the conclusion hazarded last year has been amply confirmed. The attempt to introduce *Paspalum dilatatum* has provided India with a new fodder grass of good quality, though not superior to many of the fodders already in use, but it has not supplied the country with a fodder that will thrive in seasons of scarcity and drought. It will not, I believe, be necessary to report further on this particular species.

D. PRAIN.

G. I. C. P. O.—No. 794 R. & A.—29-7-1903.—360.—J. N. S.

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